JISEA Joint Institute for Strategic Energy Analysis

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Geospatial Optimization of Siting Large-Scale Solar Projects

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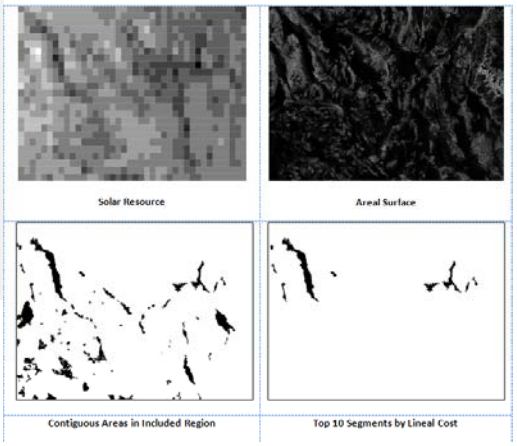
Project Description

Implementing renewable energy, such as wind and solar, requires careful placement of centralized generation facilities. The footprint may be dense relative to other forms of energy as well as long-term because the sources of energy harvested are never expended, and includes additional impacts caused by supporting infrastructure such as roads and transmission lines. To aid the siting and assessment of renewable energy projects, we developed a proof-of-concept web-based GIS tool that evaluates multiple user-defined criteria in an optimization algorithm to inform discussions and decisions regarding the locations of utility-scale solar projects. Our tool framework provides a mechanism to comprehensively evaluate, or select a site for, a proposed energy project while considering varying degrees of preference for economic considerations and environmental effects.



Optimization Routine

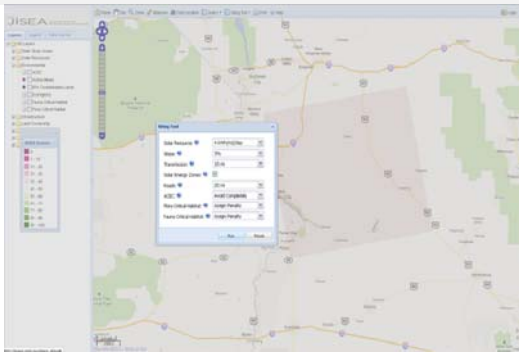
Accomplishments and Current Status

Currently, the optimization tool uses the following layers, with cost functions associated with their overlap or proximity to a potential site:

- solar resource
- land slope
- overlap with existing solar energy development zones
- proximity to transmission lines
- proximity to roads
- overlap with BLM Areas of Critical Environmental Concern
- overlap with critical plant habitat
- overlap with critical fauna habitat

How the Tool Works

After users select their criteria preferences, the siting tool outputs a map displaying a colorized "score" for each pixel in the chosen area. The score ranges from 0-100 and is based on the user-specified values for each variable. This map can be used in comparisons with existing projects and solar development zones. In addition, location information can also be cross-referenced and used on other software programs designed for large-scale solar analysis, such as the Solar Power Prospector and the System Advisor Model



Example user interface

Next Steps

Future work could link optimization software and the web-interface elements so they run on the same server with shared inputs and outputs. We recommend future versions use a modified software architecture.

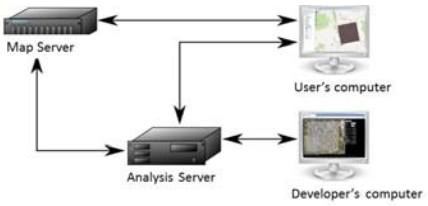
We recommend increasing the number of variables used in the optimization equation. For example: water availability, existing land use, land ownership, local permitting requirements, visual impact , and cultural impact.

Increased feedback from stakeholders (e.g., industry, environmental organizations, permitting agencies) would likely improve the treatment of different variables.

This tool could be expanded to address energy developments for other fuels and technologies, such as wind, geothermal, biomass, natural gas, oil, and uranium.

Expected Outcomes and Applications

A finalized, public-ready tool would allow consolidation of energy resources and potential from all energy sectors and provide a mechanism to comprehensively evaluate a proposed energy project, evaluate between competing energy and mineral projects, or select a site for a new energy project. The tool could inform policy makers and industry representatives in their solar project siting decisions by giving all stakeholders a common framework by which they can discuss economic and environmental tradeoffs associated with different development locations.



System diagram

Strategic Benefit

The proof-of-concept siting assistance tool we have developed improves upon the shortcomings of the existing siting guidelines by having the following qualities:

- User-driven
- Transparent
- Web-based and interactive
- Multi-criteria optimization routine, not map overlays
- Use of existing data
- Flexible

Example tool output

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